

FIG. 1 (Prior Art)

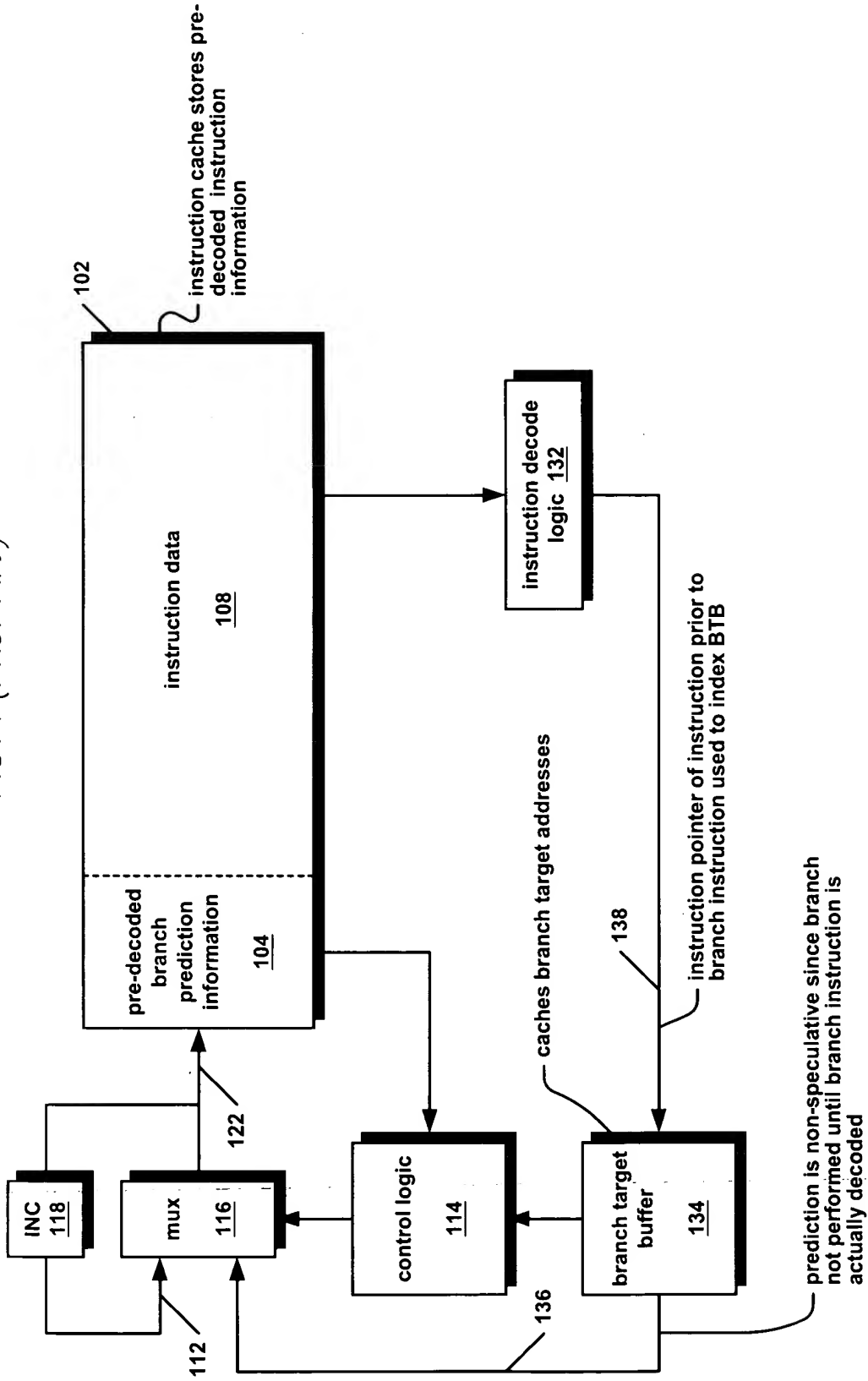


FIG. 2 (Prior Art)

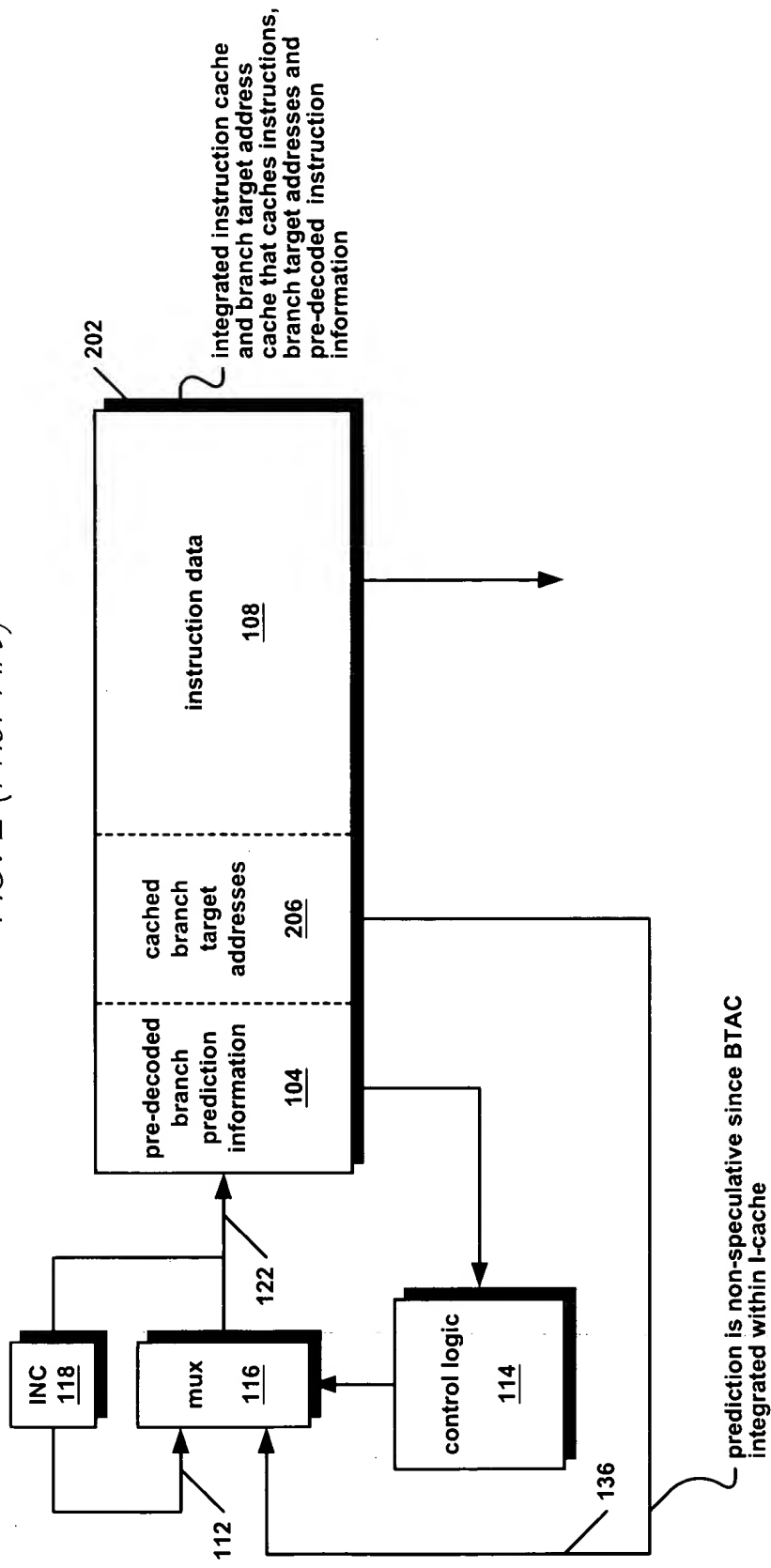
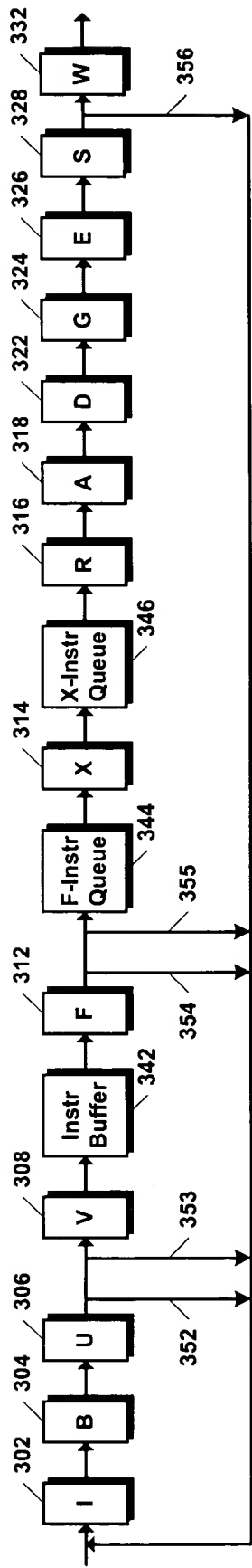
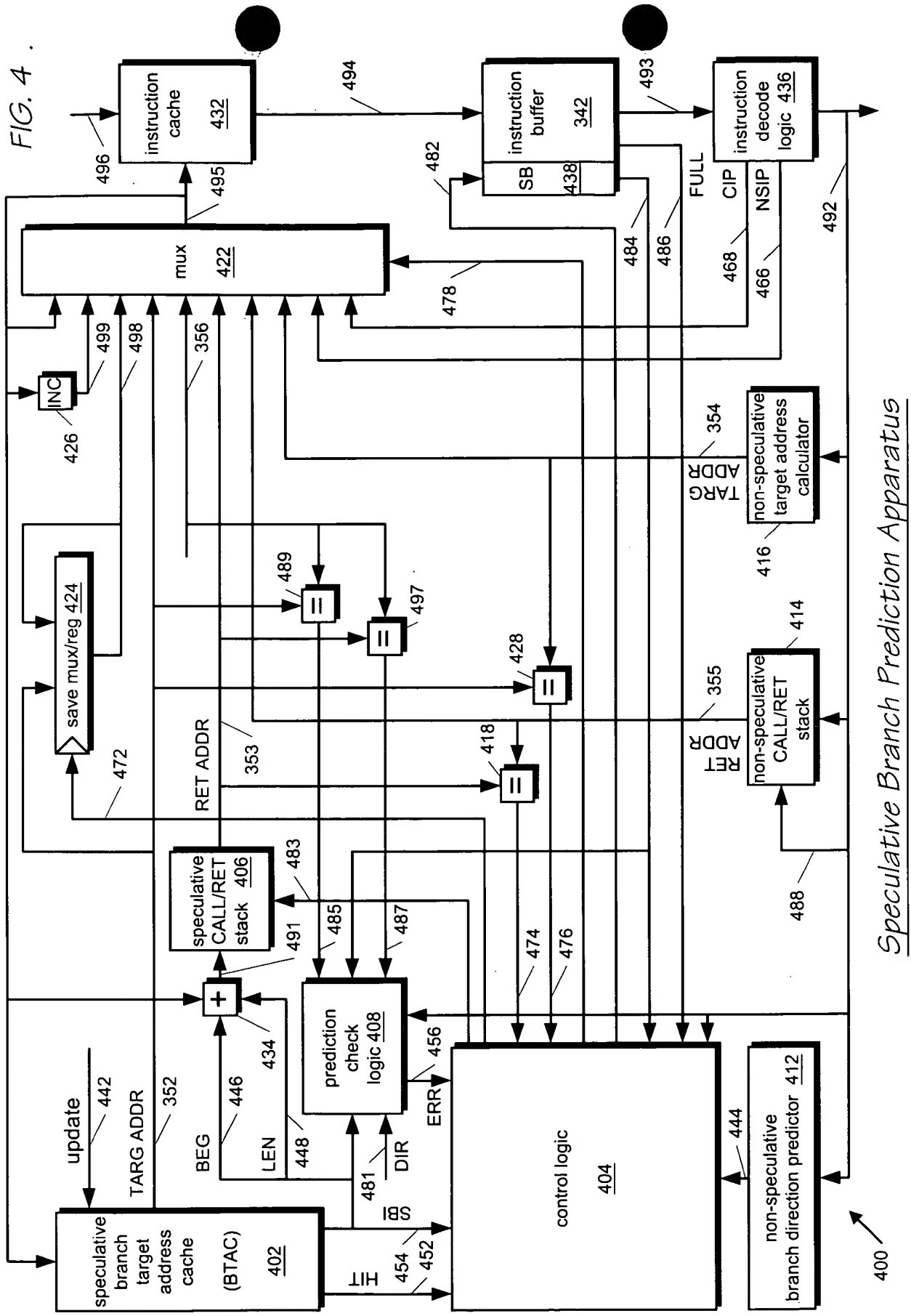


FIG. 3



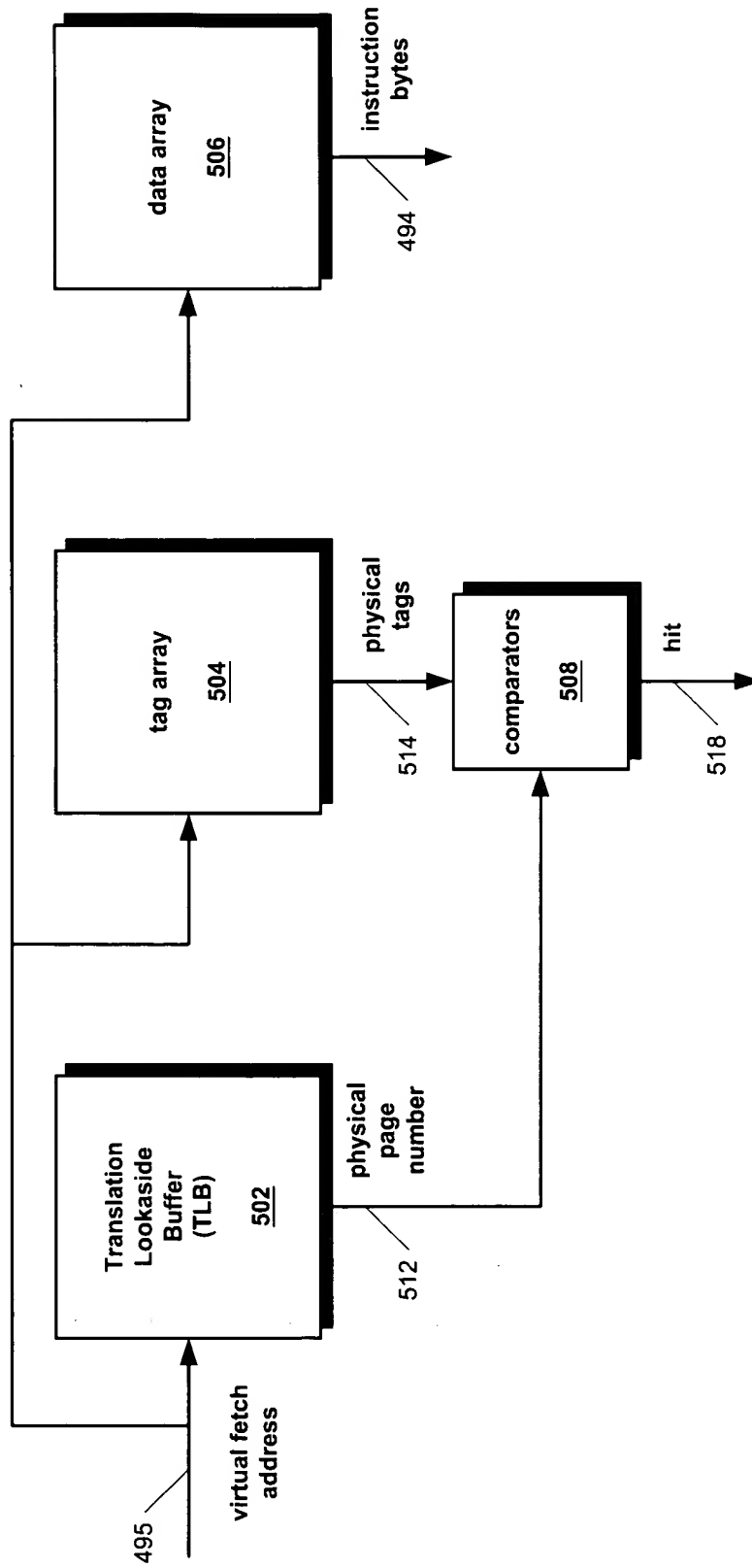
300

Processor Pipeline Stages



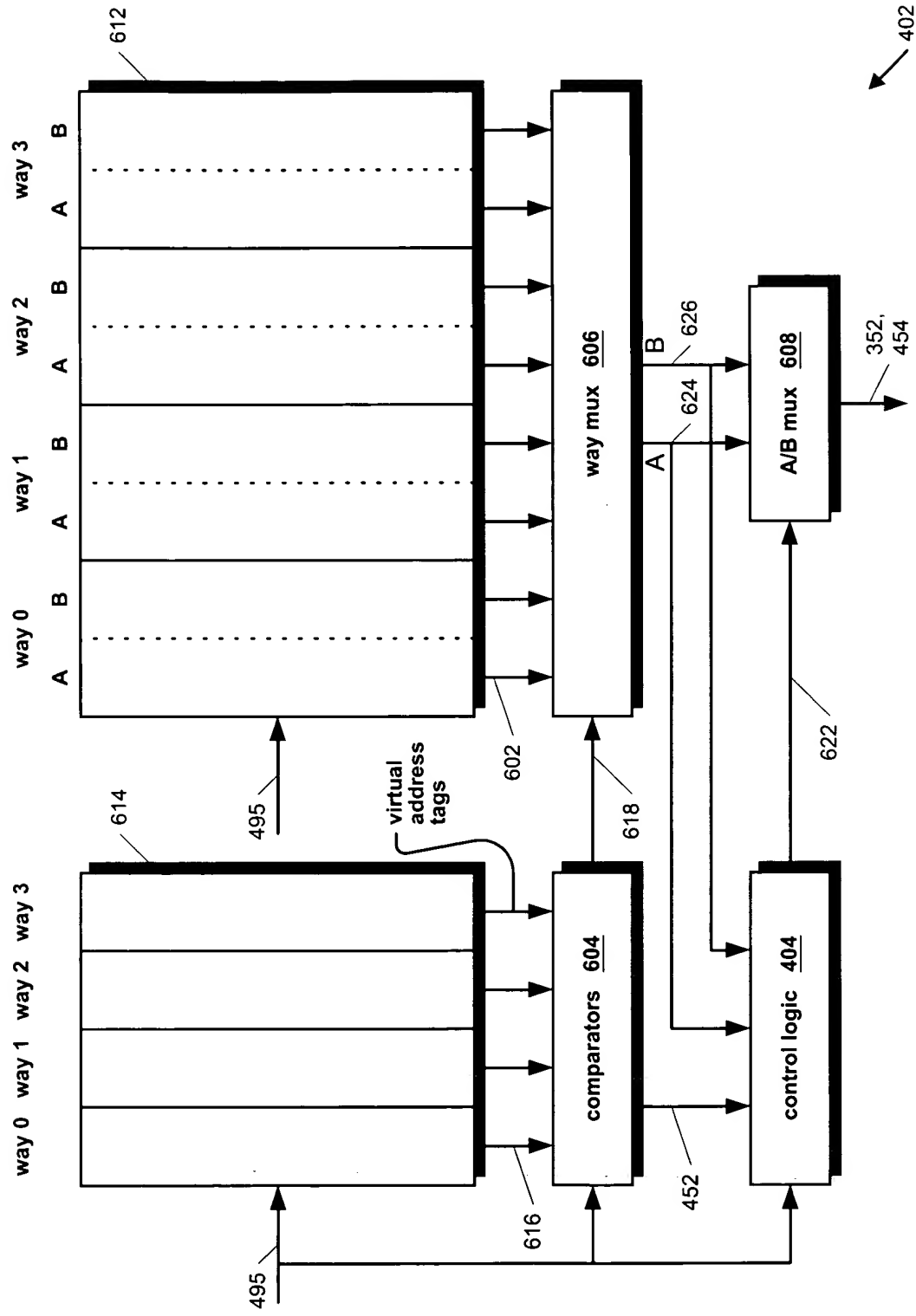
Speculative Branch Prediction Apparatus

FIG. 5



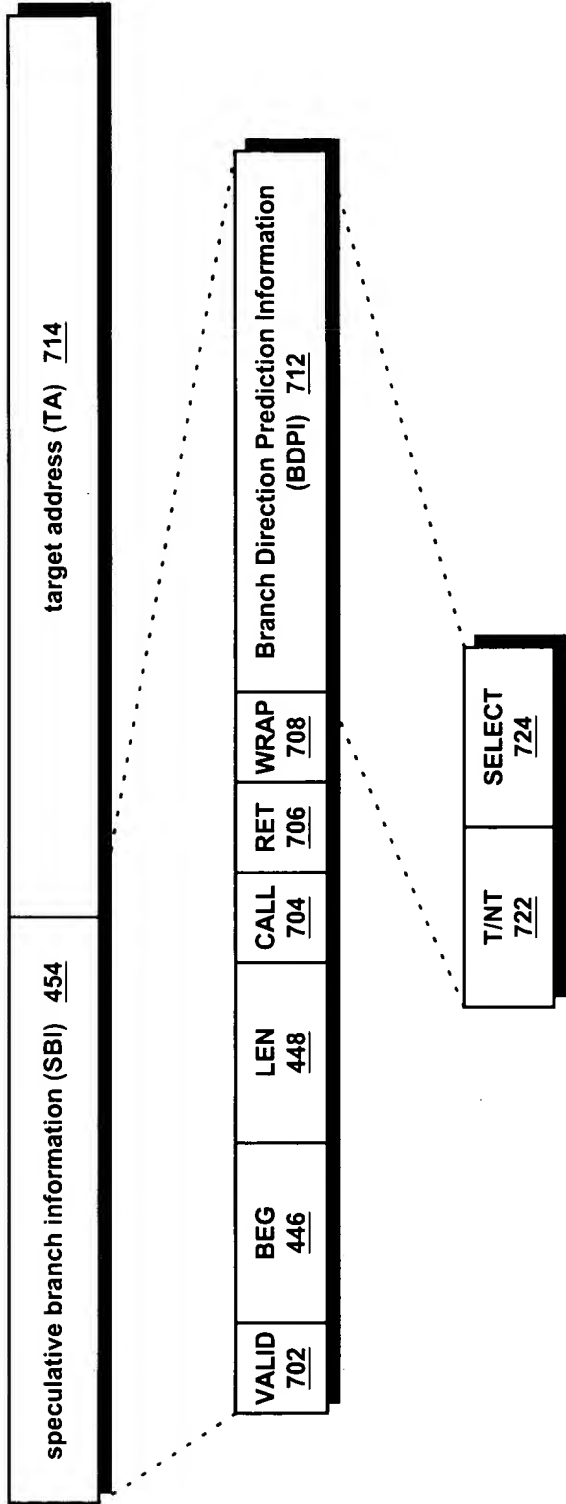
Instruction Cache

FIG. 6



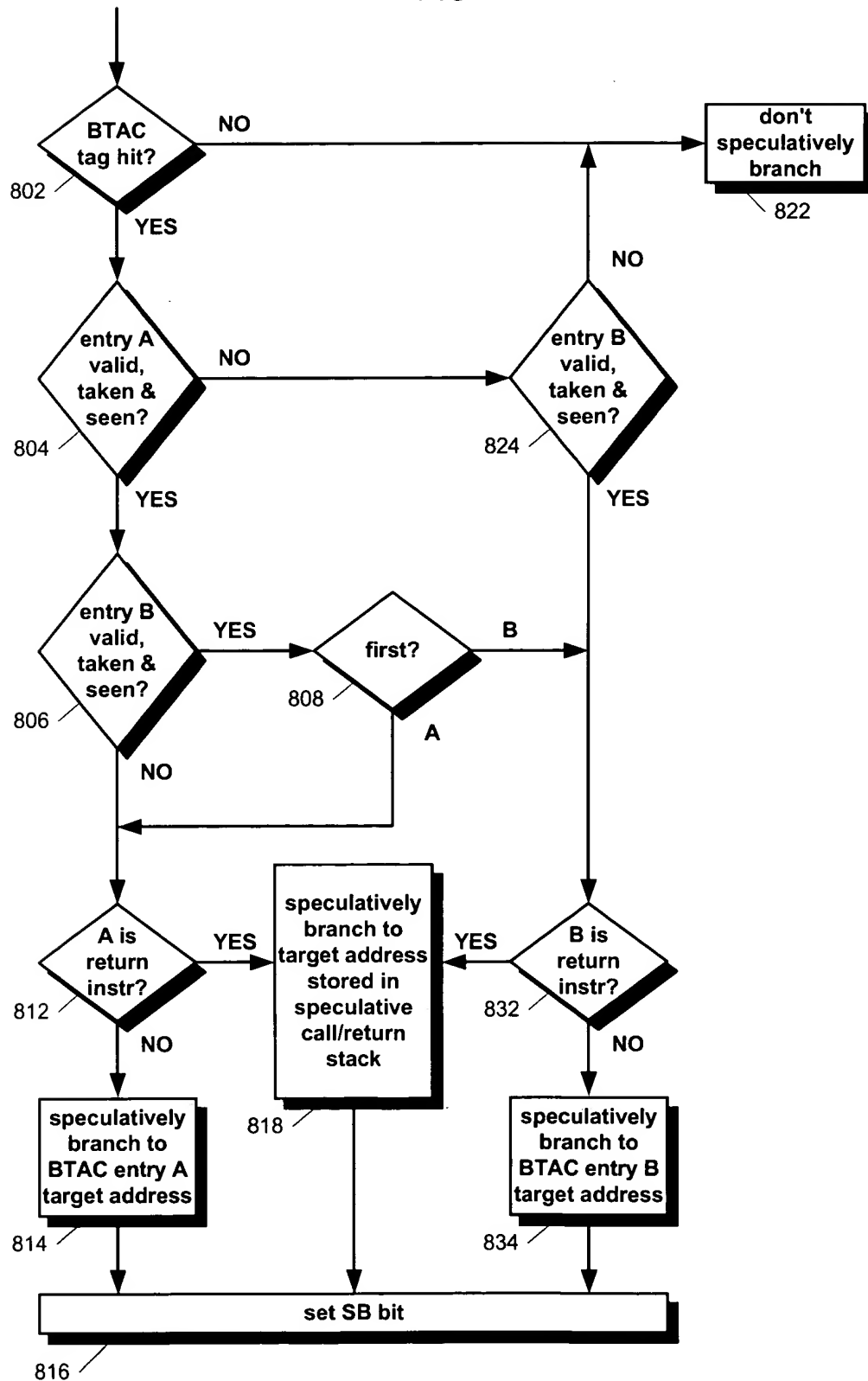
BTAC

FIG. 7



BTAC Entry

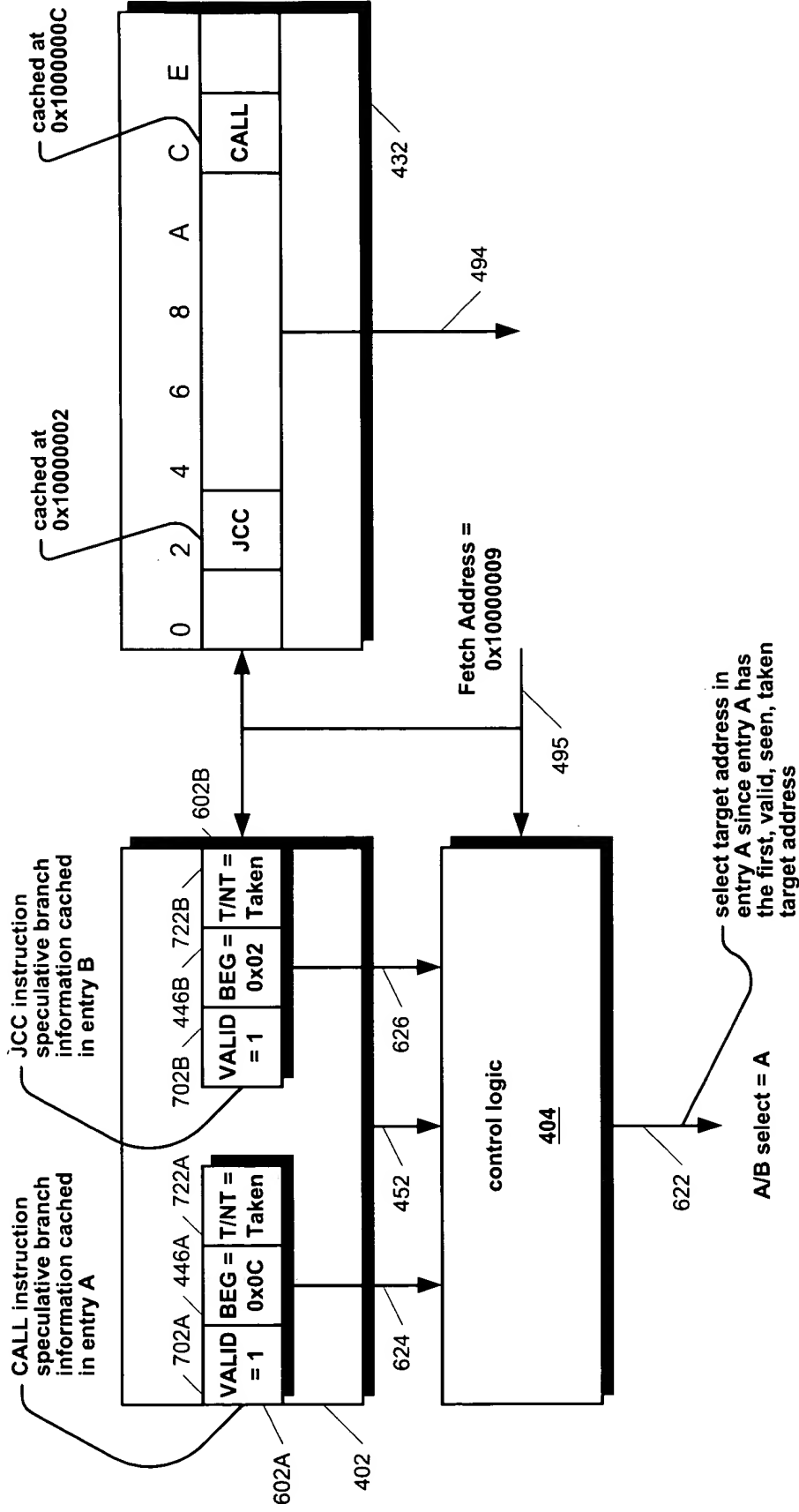
FIG. 8



Speculative Branching Operation

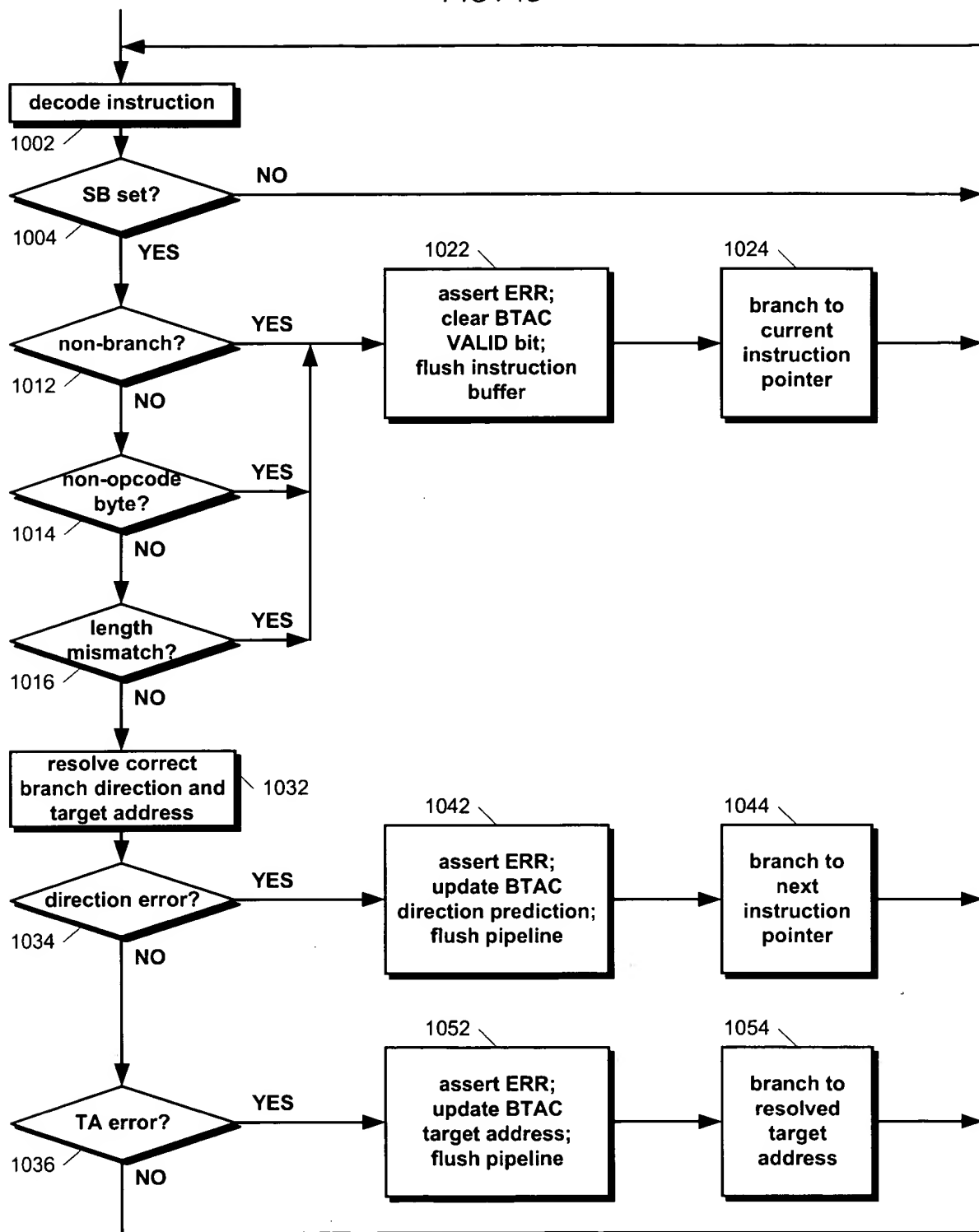


FIG. 9



Target Address Selection Example

FIG. 10



Detection and Correction of  
Speculative Branch Misprediction

FIG. 11

Previous Code Sequence:

0x00000010    JMP    0x00001234

...

Current Code Sequence:

0x00000010    ADD    ;address 0x00000010 hits in BTAC generating a TA value of 0x00001234

...

0x00001234    SUB

0x00001236    INC

clock →	1	2	3	4	5	6	7
I-stage	ADD	X	X	SUB	INC	X	ADD
B-stage		ADD	X	X	SUB	X	X
U-stage			ADD	X	X	X	X
V-stage				ADD	X	X	X
F-stage					ADD	X	X

Cycle 1 = BTAC and I-cache access cycle

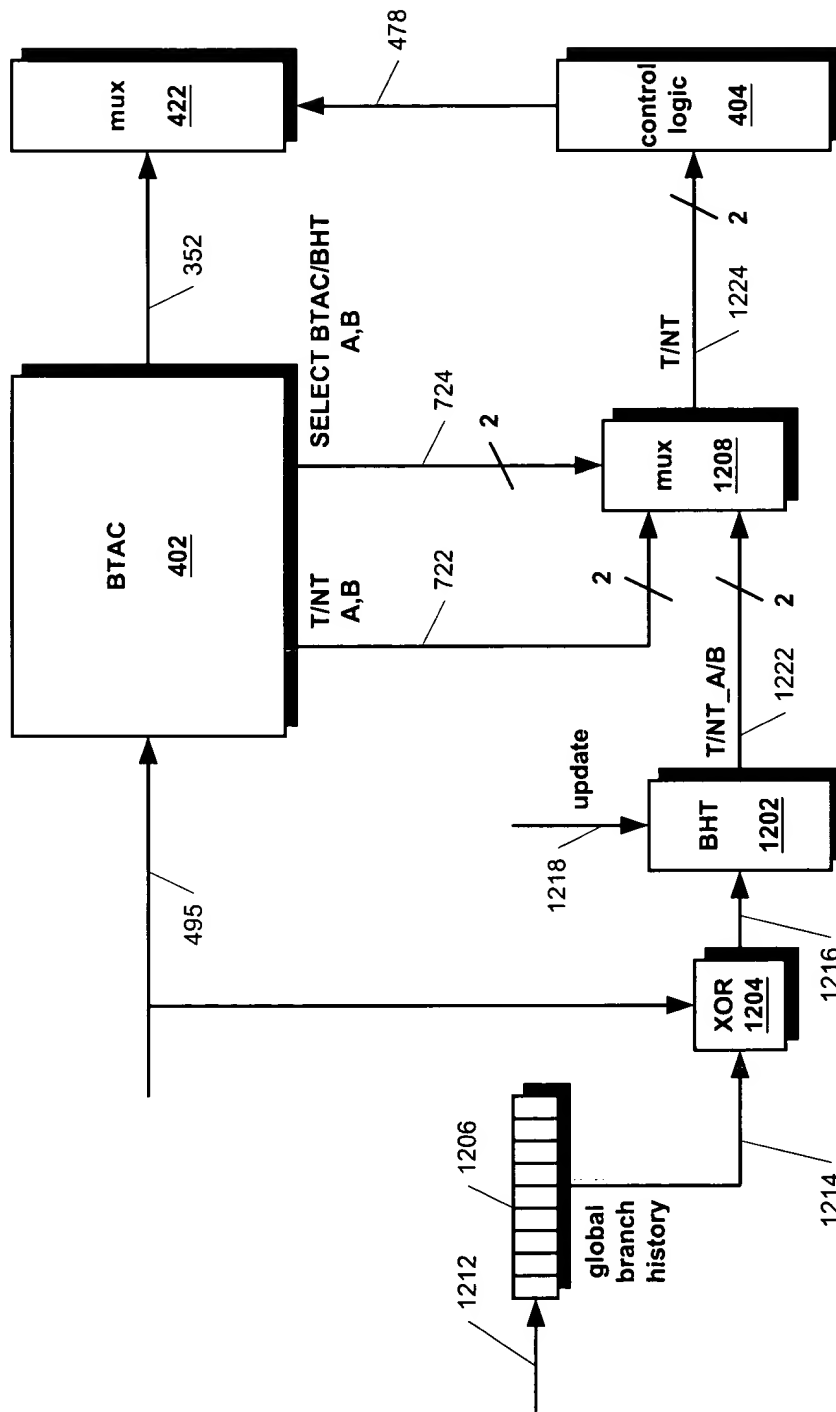
Cycle 4 = speculative branch cycle

Cycle 5 = speculative branch error detection cycle

Cycle 6 = BTAC invalidate cycle

Cycle 7 = speculative branch error correction cycle

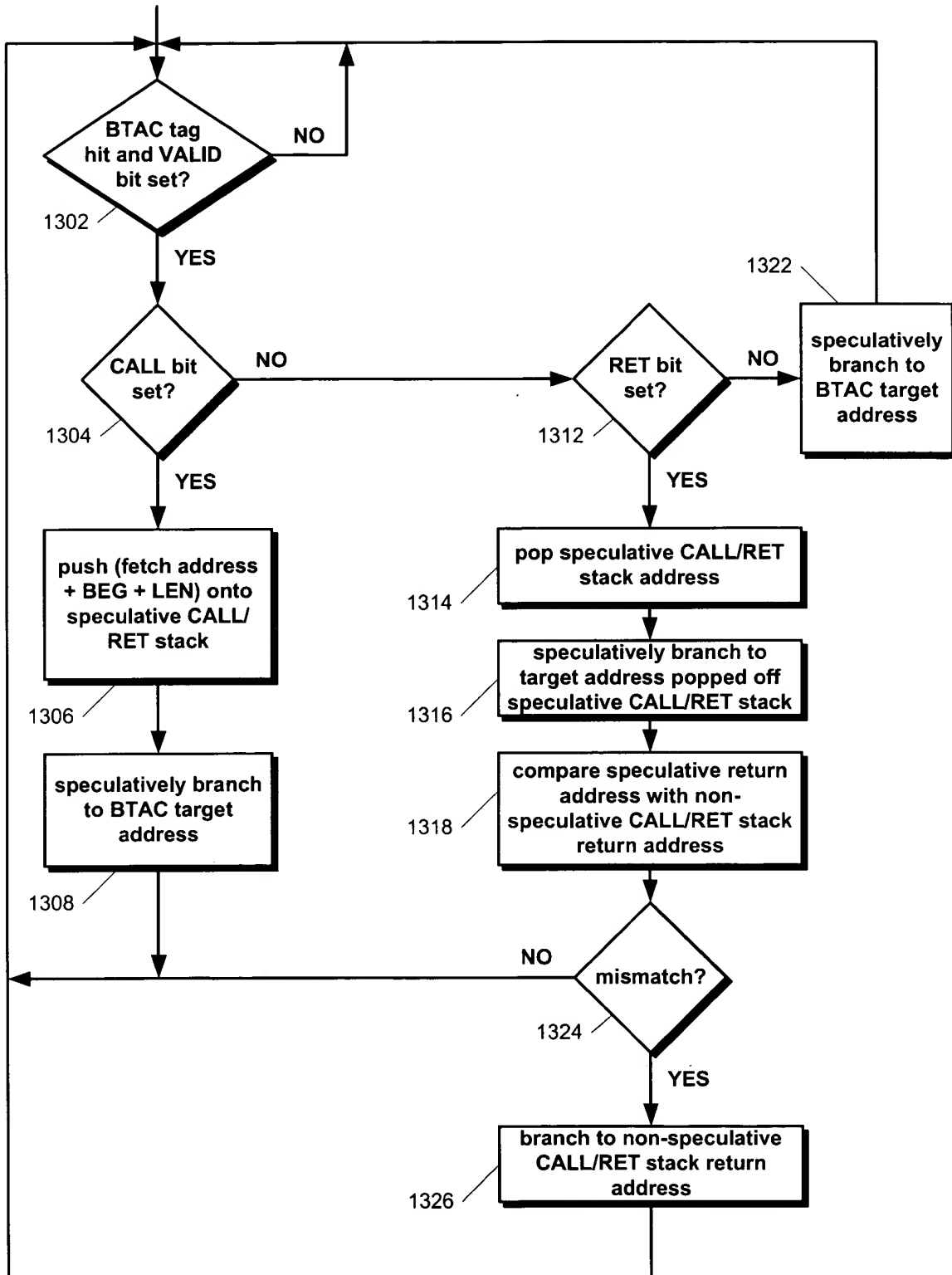
FIG. 12



1200

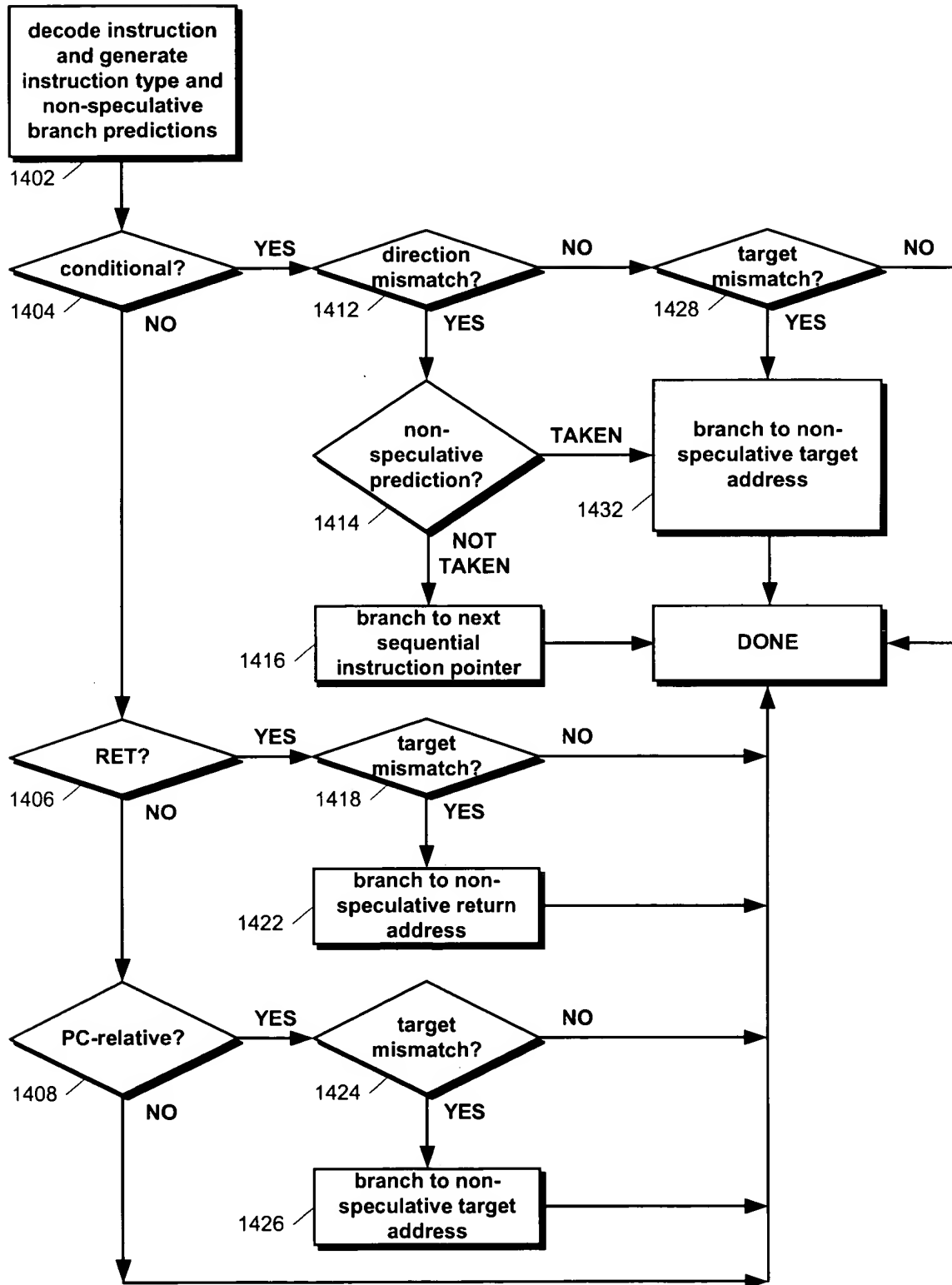
Hybrid Speculative Branch Direction Predictor

FIG. 13



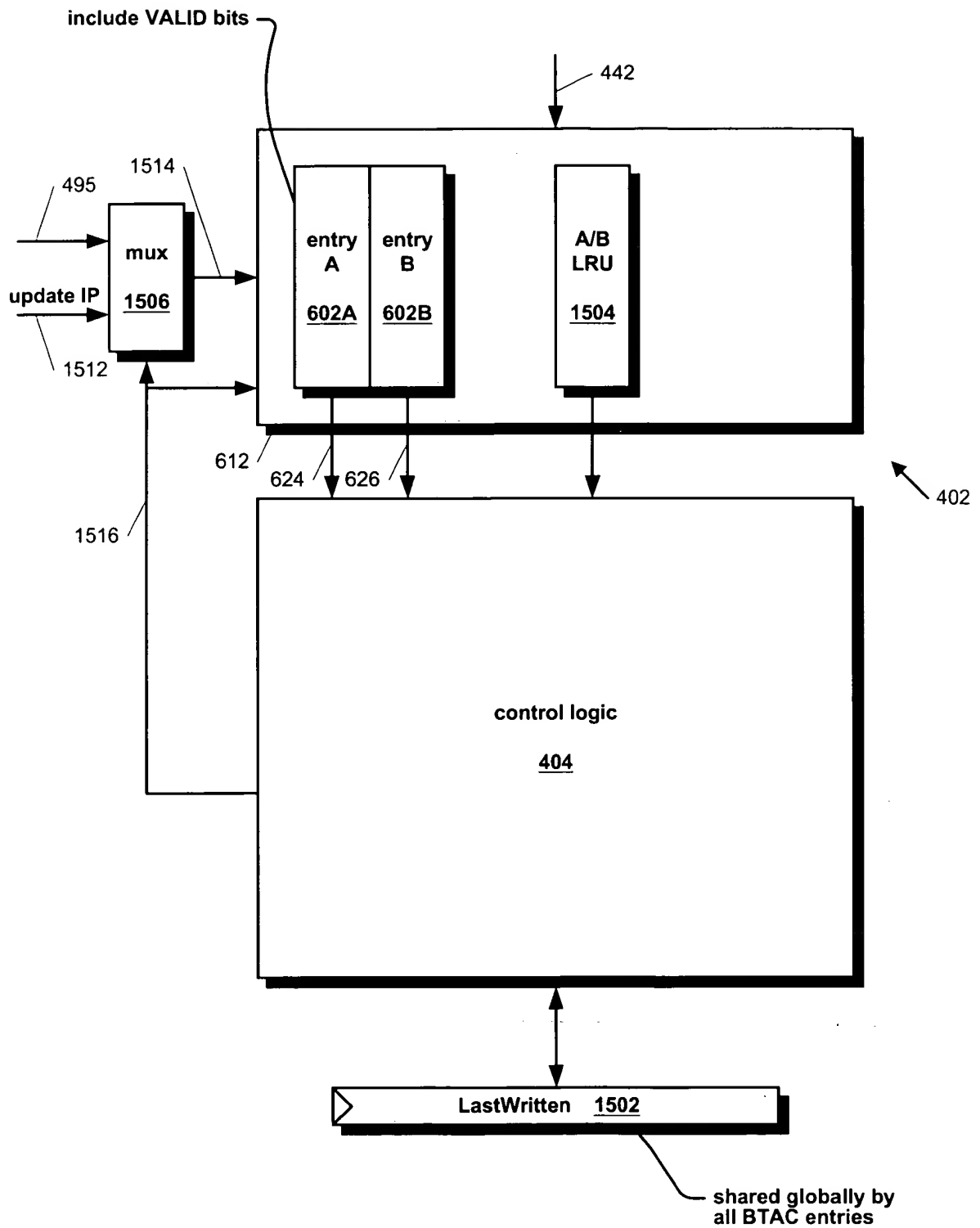
Dual CALL/RET Stack Operation

FIG. 14



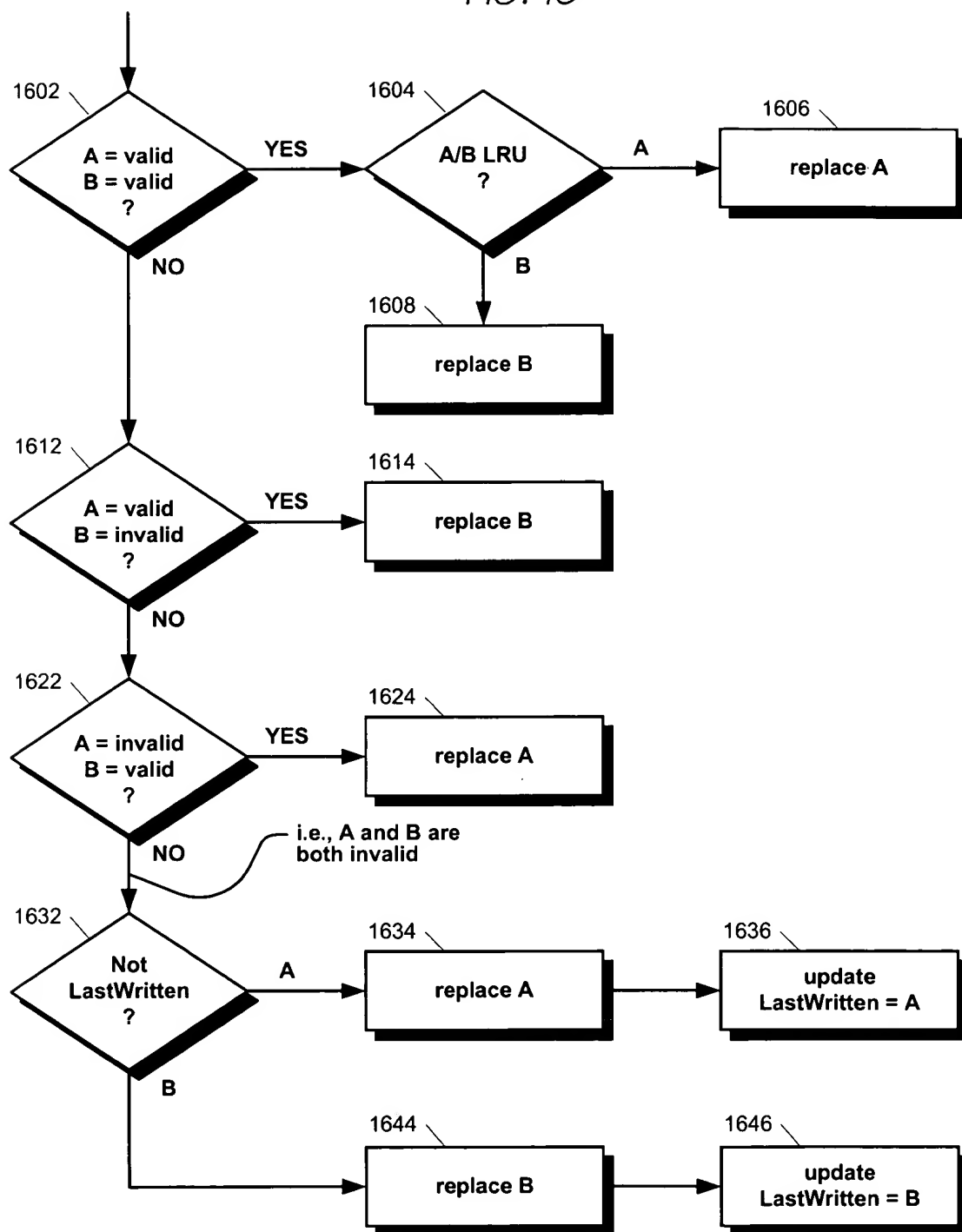
Selective Override of BTAC Prediction Operation

FIG. 15



BTAC A/B Replacement Apparatus

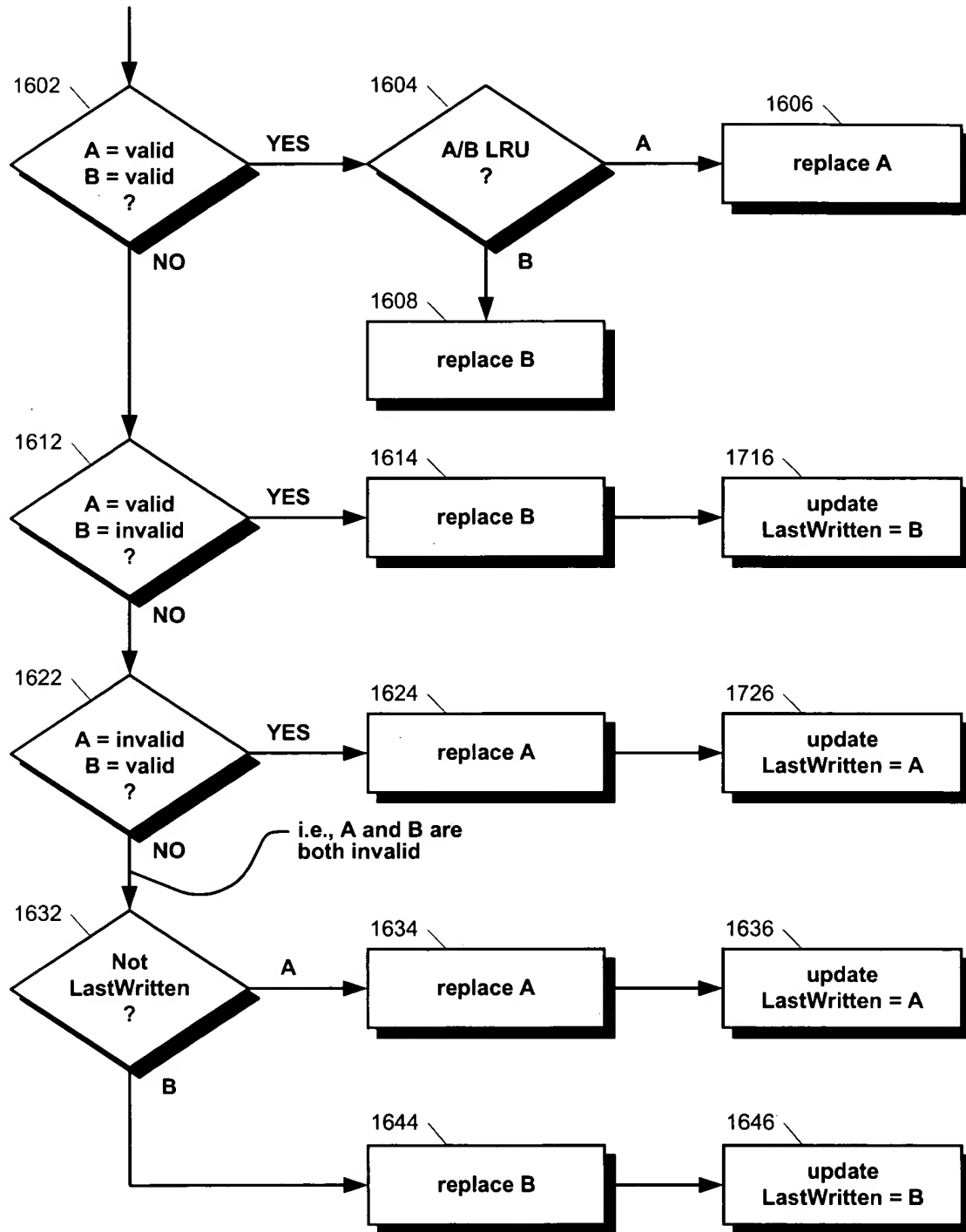
FIG. 16



A/B Entry Replacement Method

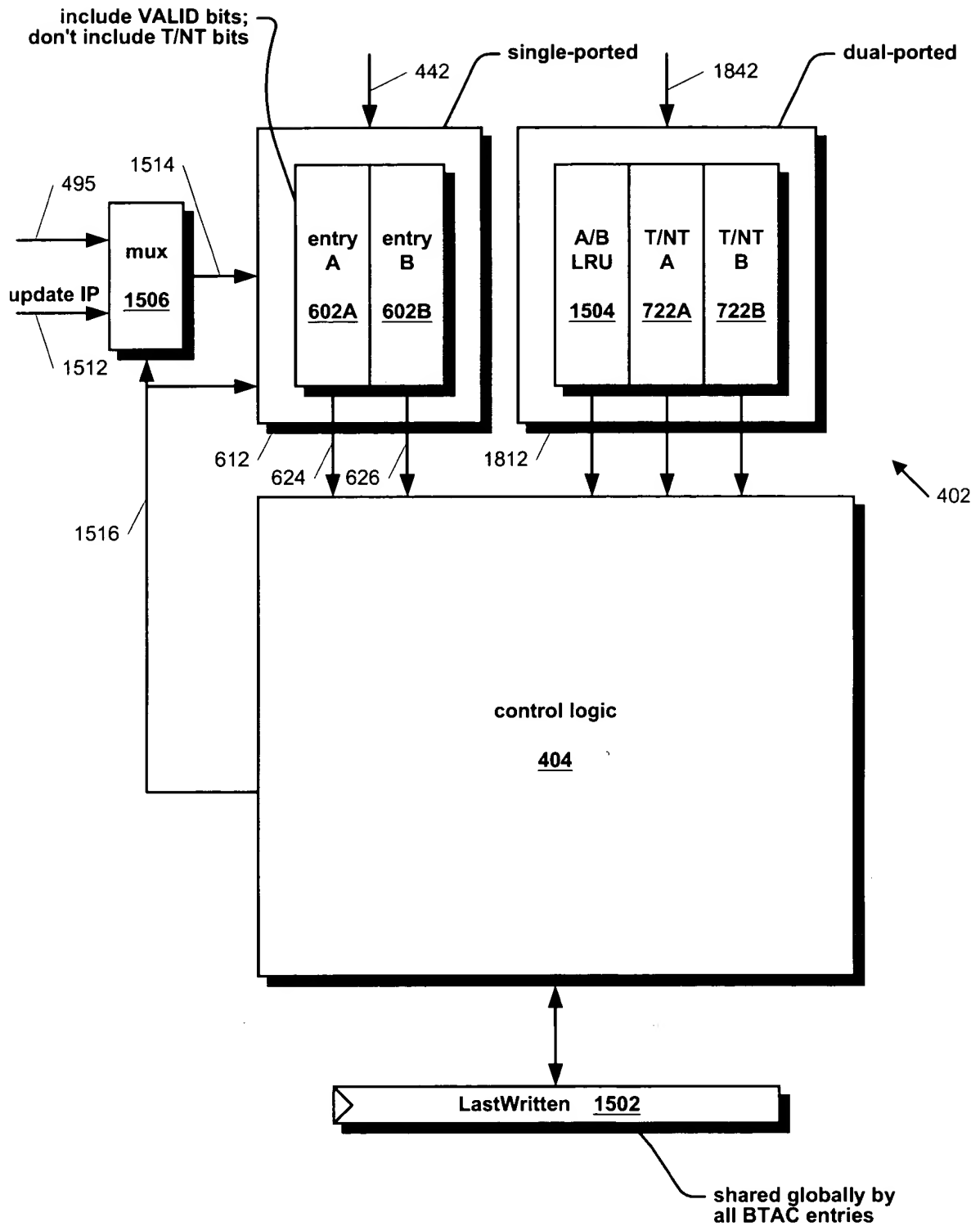


FIG. 17



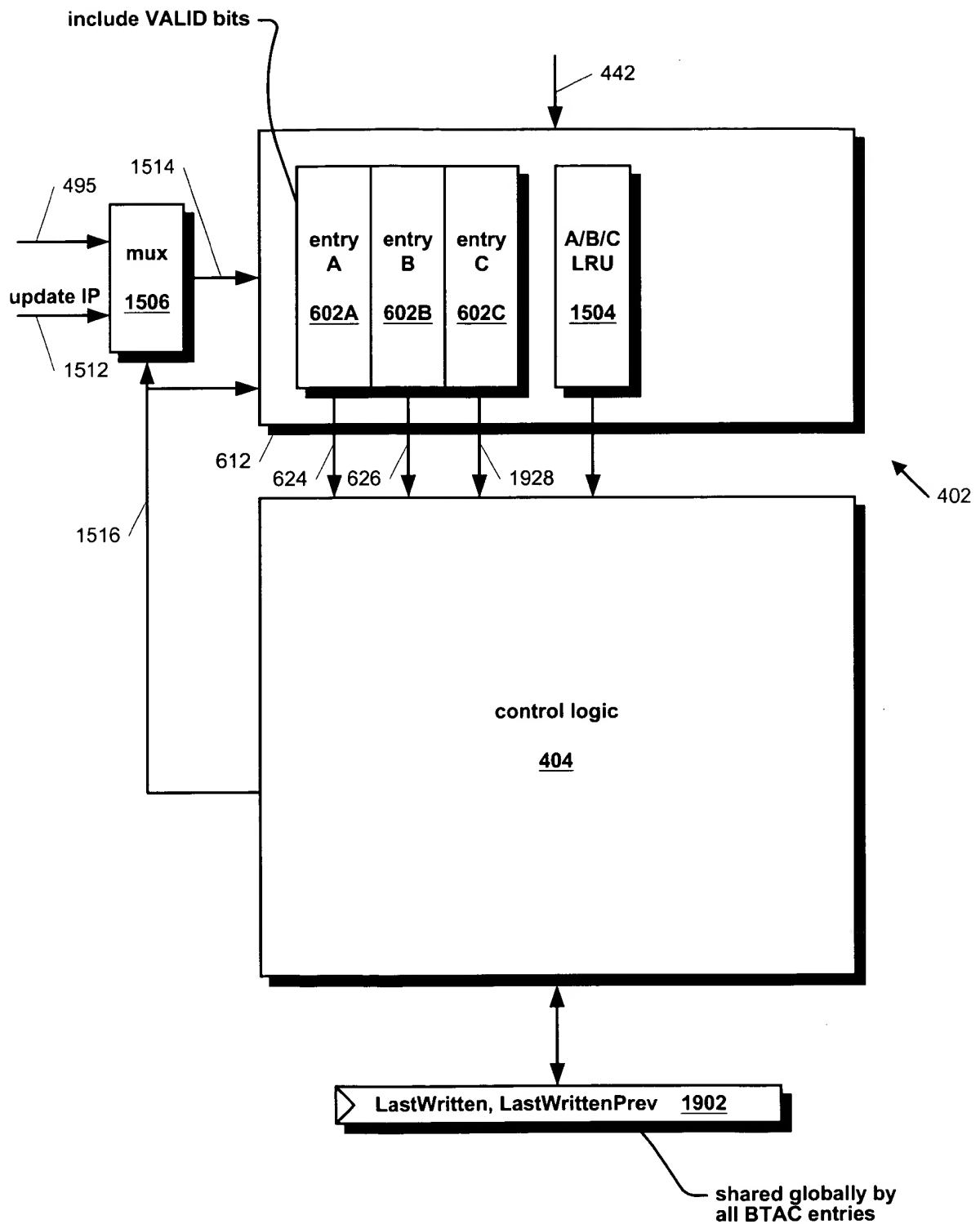
A/B Entry Replacement Method (Alt. Embodiment)

FIG. 18



BTAC A/B Replacement Apparatus (Alt. Embodiment)

FIG. 19



BTAC A/B/C Replacement Apparatus